Impervious Surface

Accuracy Assessment and Change Analysis

Delaware Coastal Communities

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Impervious Surface

Accuracy Assessment and Change Analysis

Project objectives:

1) Assess the accuracy of the impervious GIS layer for 2007 and 2016
2) Determine the change in impervious surface cover from 2007 to 2016

Delaware coastal communities of Cities of **Rehoboth Beach** and **Lewes**, and the Towns of **Henlopen Acres**, **Dewey Beach**, **Bethany Beach**, **South Bethany** and **Fenwick Island**

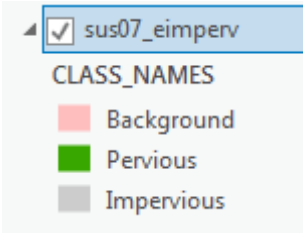
Impervious surface data

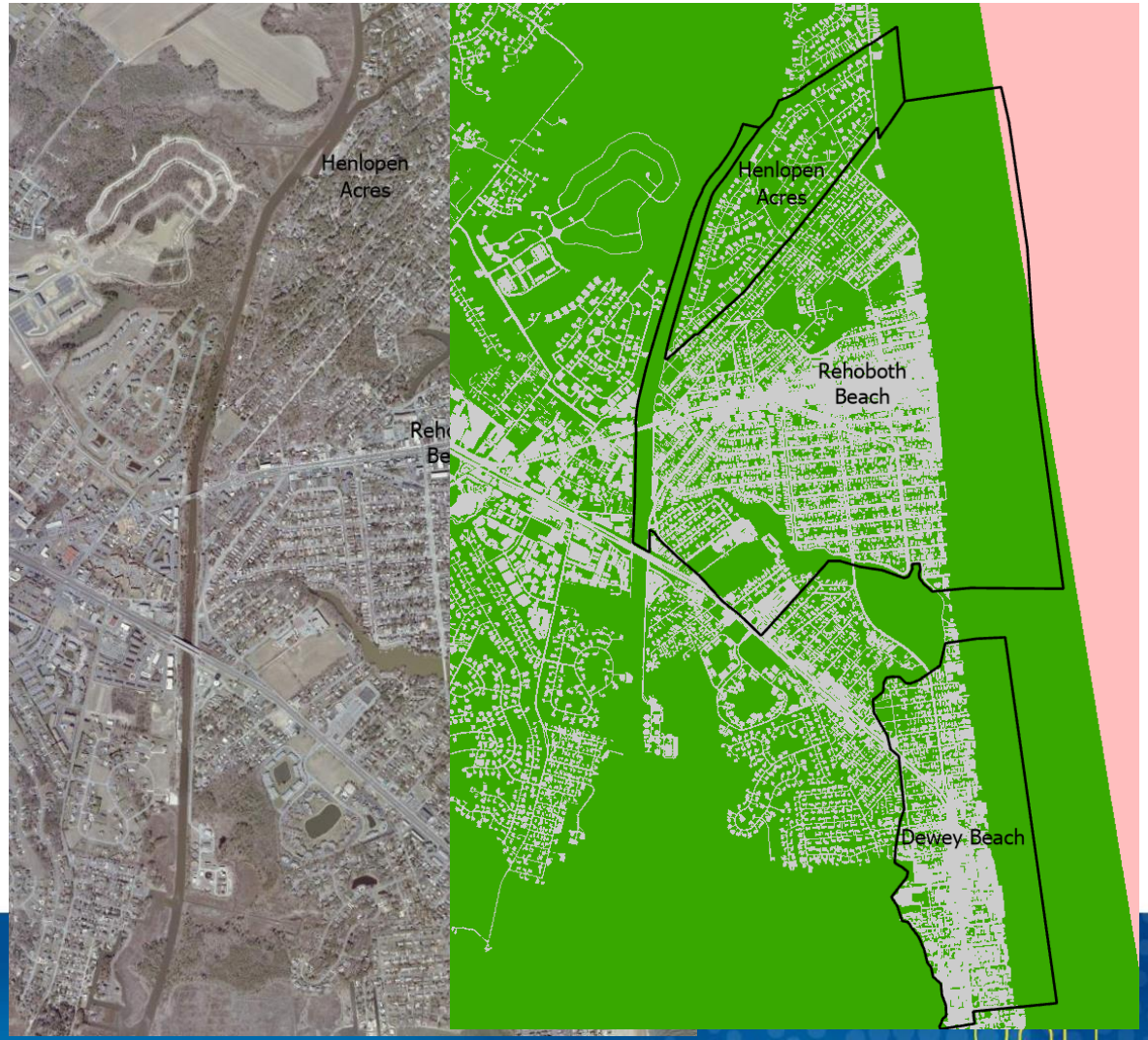
2007 Delaware impervious surface layer

2016 Chesapeake Conservancy impervious surface layer

2007 Delaware Layer

- Based on 2007 aerial imagery
- Imagery at 0.25 meter by 0.25 meter spatial resolution with 4 bands (blue, green, red, NIR)
- Impervious surface layer at 1 meter by 1 meter resolution with 3 pixels values (legend shown below).





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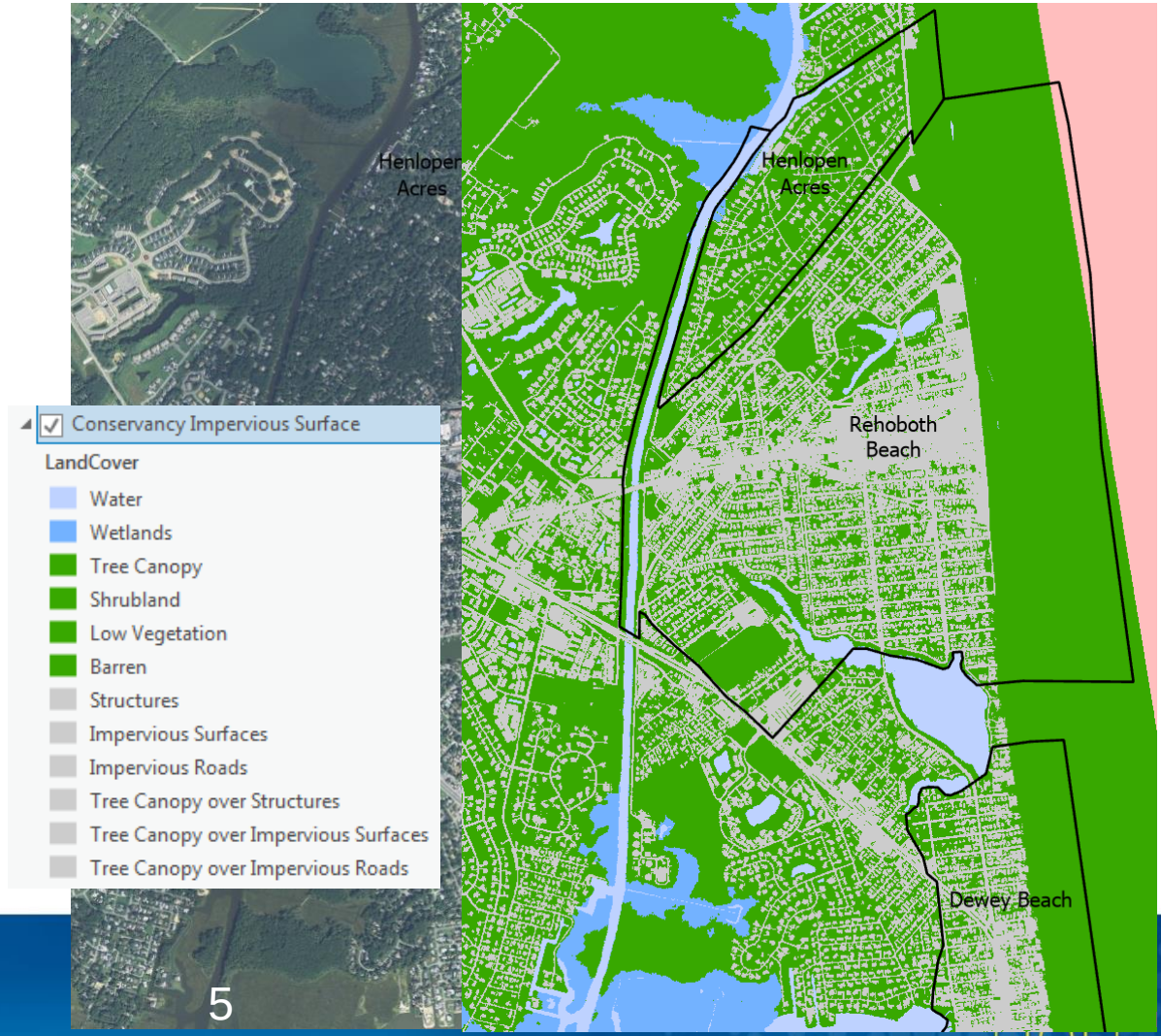
2016 Conservancy Layer

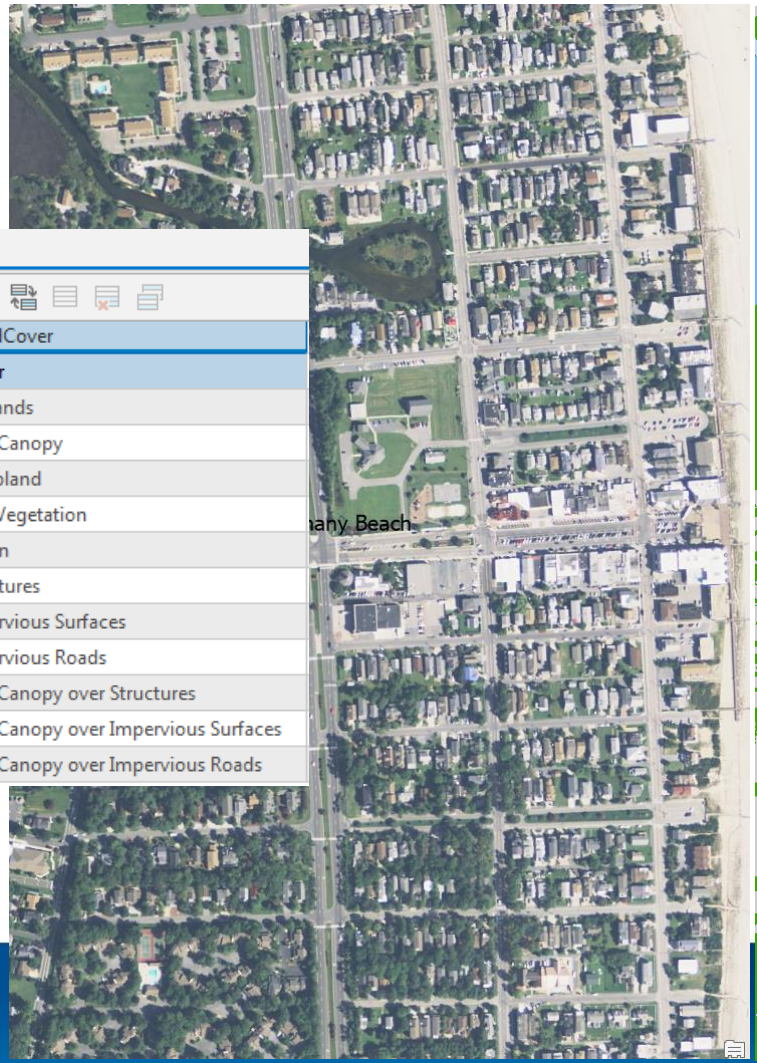
- Represents land cover conditions as evident in National Agricultural Imagery Program (NAIP) imagery for years 2013/2014
- Imagery has spatial resolution of 0.5 meter by 0.5 meter with 3 bands (true color – blue, green, red)
- Impervious surface layer at 1 meter spatial resolution with 11 pixel values (shown in legend).



SUSS_10005.img

Field: Selection:

OID	Value	Count	LandCover
0	1	142916273	Water
1	2	89577138	Wetlands
2	3	965912194	Tree Canopy
3	4	36357623	Shrubland
4	5	1153336337	Low Vegetation
5	6	18621704	Barren
6	7	36003615	Structures
7	8	45772060	Impervious Surfaces
8	9	44754344	Impervious Roads
9	10	5405006	Tree Canopy over Structures
10	11	6704482	Tree Canopy over Impervious Surfaces
11	12	4595087	Tree Canopy over Impervious Roads



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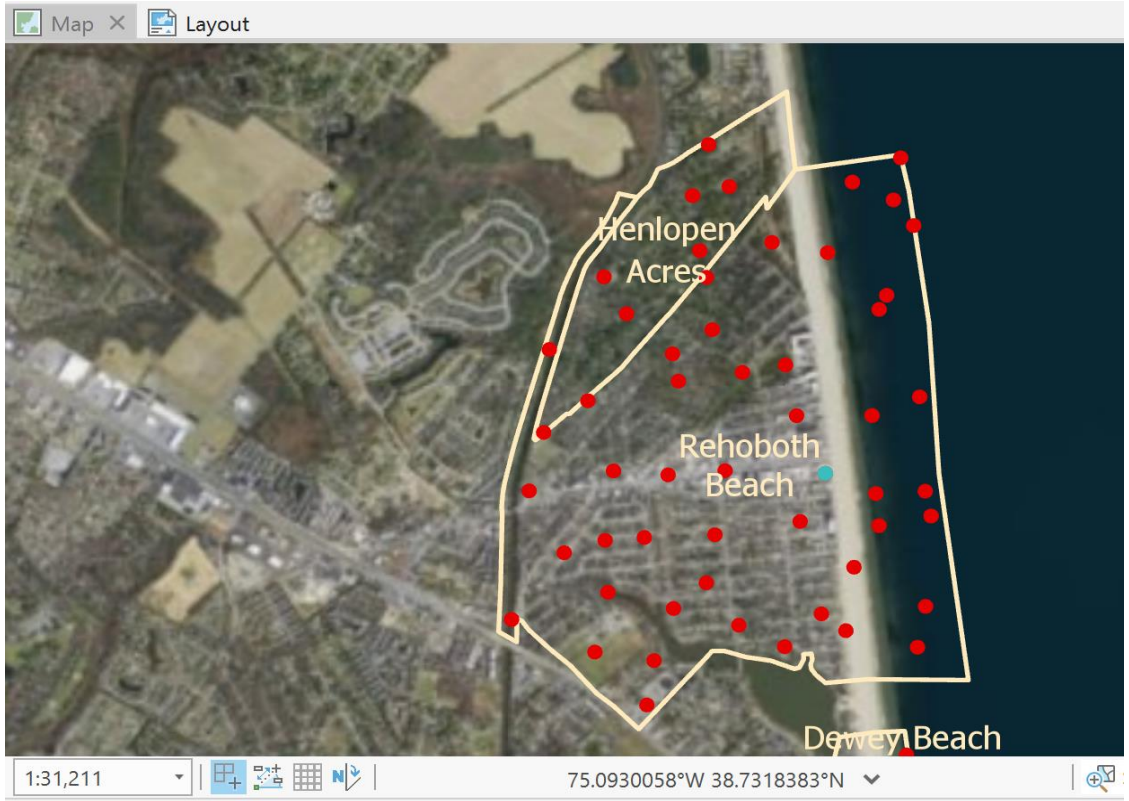
Accuracy Assessment

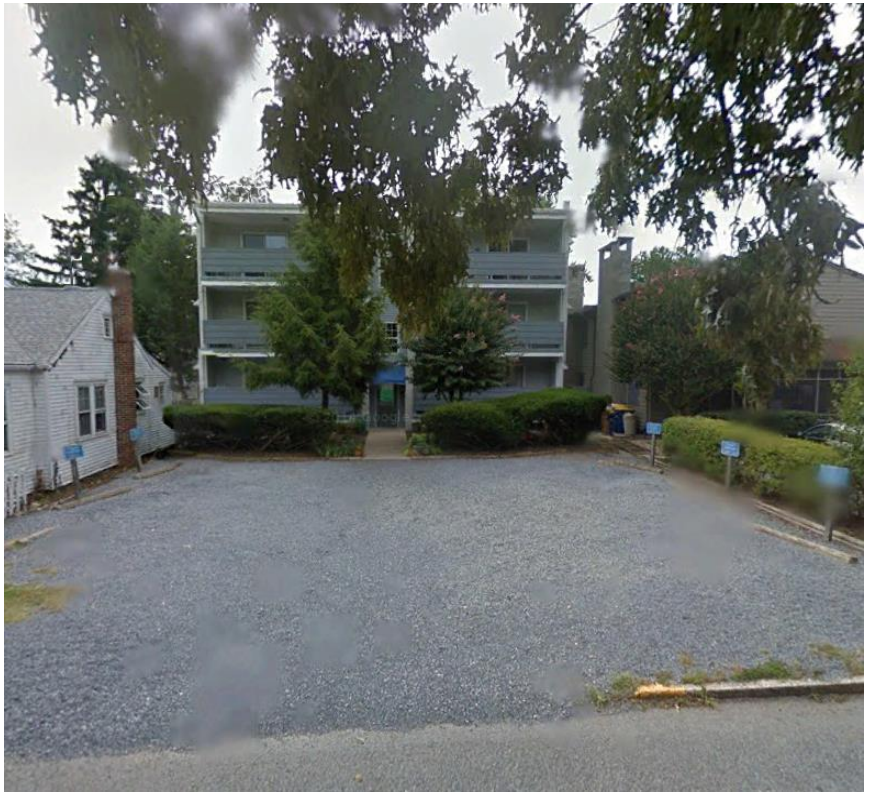
1. Created stratified sampling grid of 300 meter by 300 meter, and selected random point within each grid. Resulted in **262** sampling point (red)
2. Assign Delaware and Conservancy layers land cover to each assessment point.
3. Assess whether layers' land cover correct using Google Earth (and StreetView). Checked once by student, second by me.



Extract_create_4

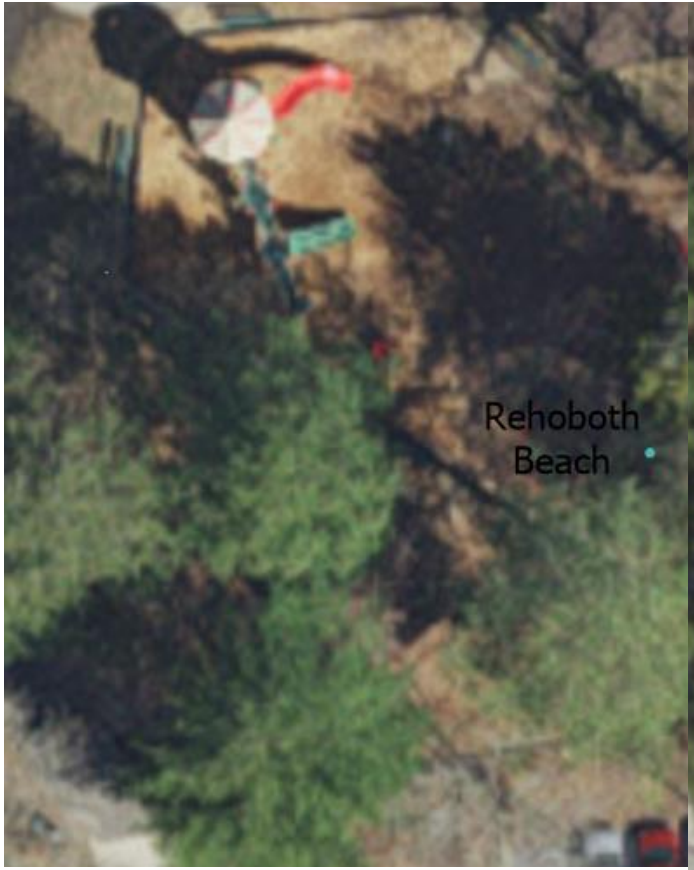
Field: Add Delete Calculate | Selection: Zoom To Switch Clear Delete Copy

OBJECTID	Shape	CID	RASTERVALU	RED	GREEN	BLUE	OPACITY	CLASS_NAMES
159	Point	4203	2	0	0.392157	0	1	Impervious
157	Point	4204	2	0	0.392157	0	1	Impervious
158	Point	4205	2	0	0.392157	0	1	Impervious



Google Earth and StreetView

Example of surfaces difficult to assess

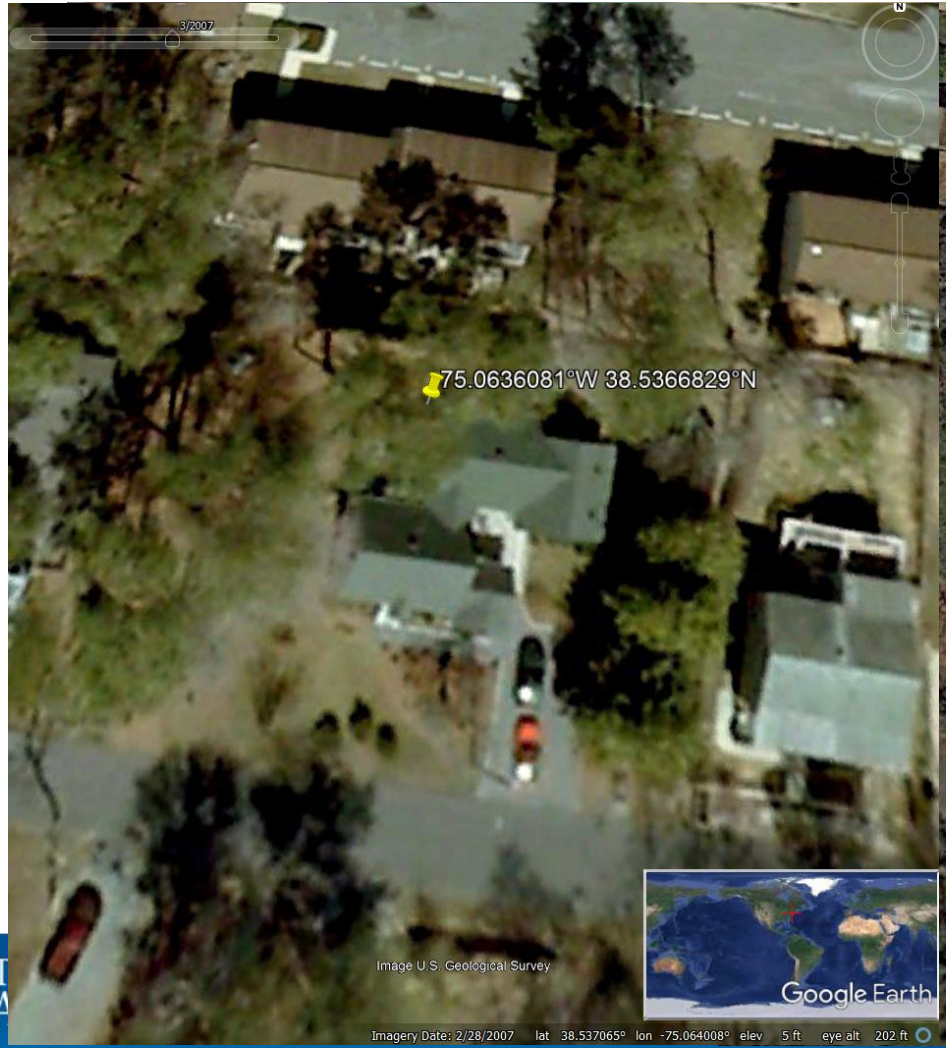

Rehoboth
Beach

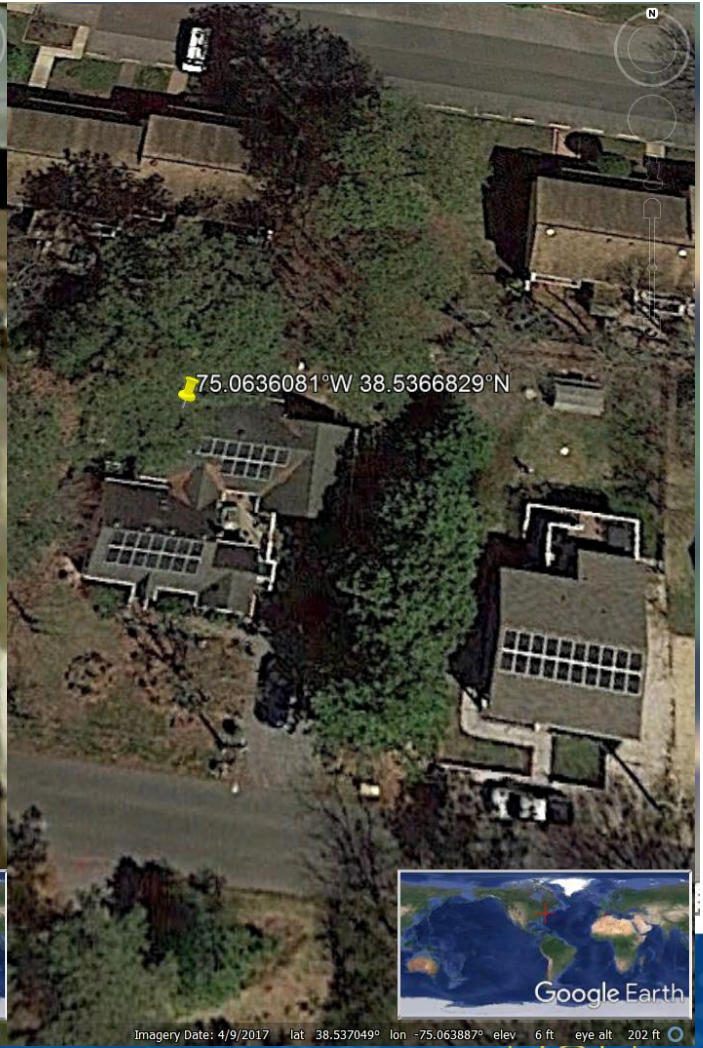

Bethany Beach

Copy **assessment point x,y** coordinates, paste into Google Earth

Use of Google Earth time slider - go back to 2007 and forward to 2013/14 and today.

1. 2007 Delaware imagery
2. 2013 NAIP imagery
3. Google Earth 2007 and 2019





Accuracy Assessment Results

Of the 262 assessment points, 2 were discarded for the Delaware layer within the background area and 32 discarded for Conservancy layer.

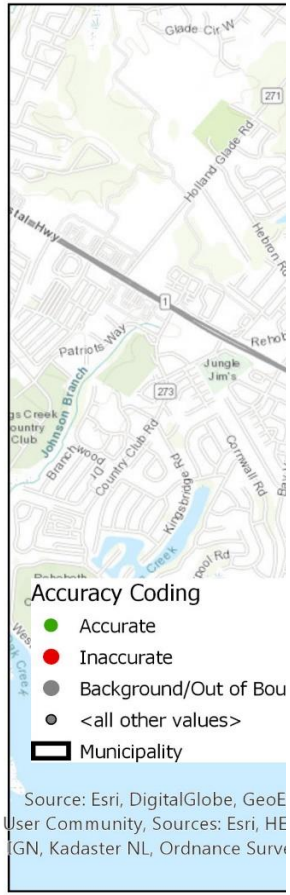
228 assessment point

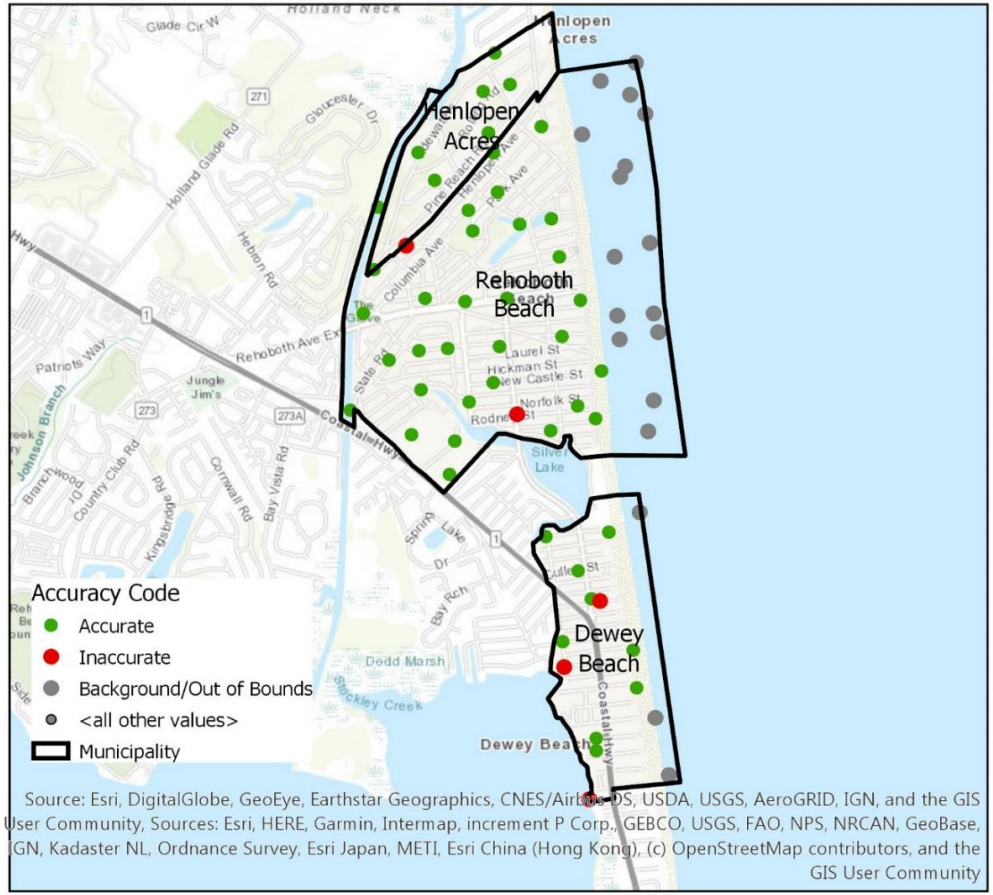
Delaware layer - 93.5%

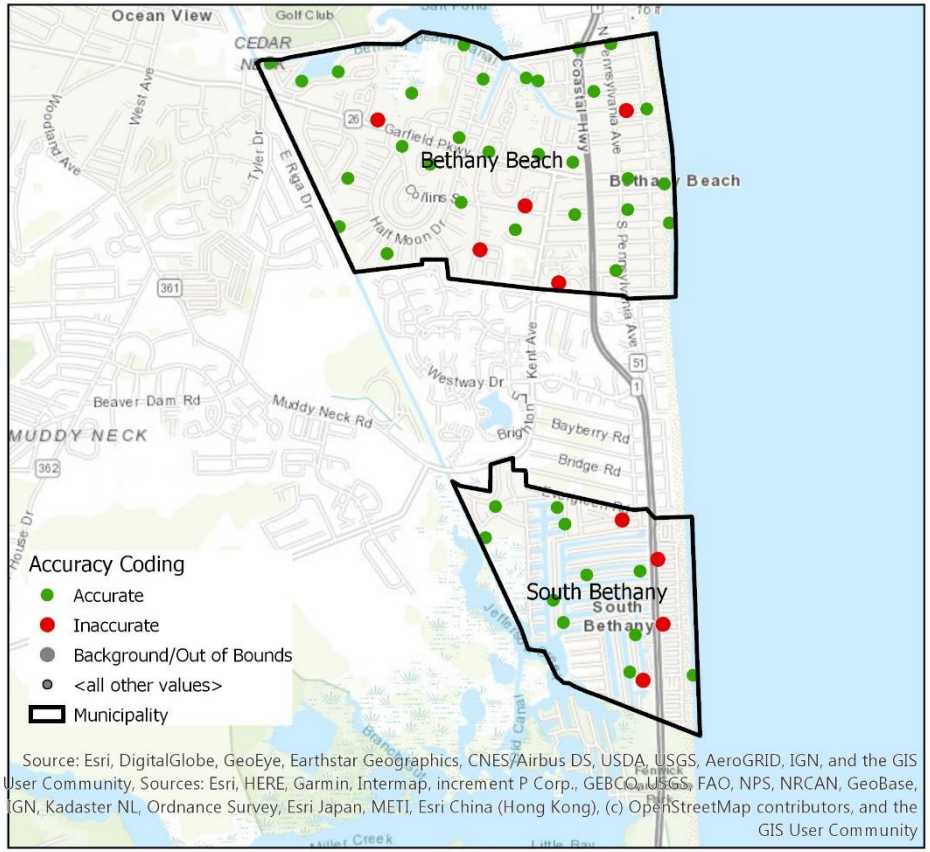
Conservancy - 92.2%

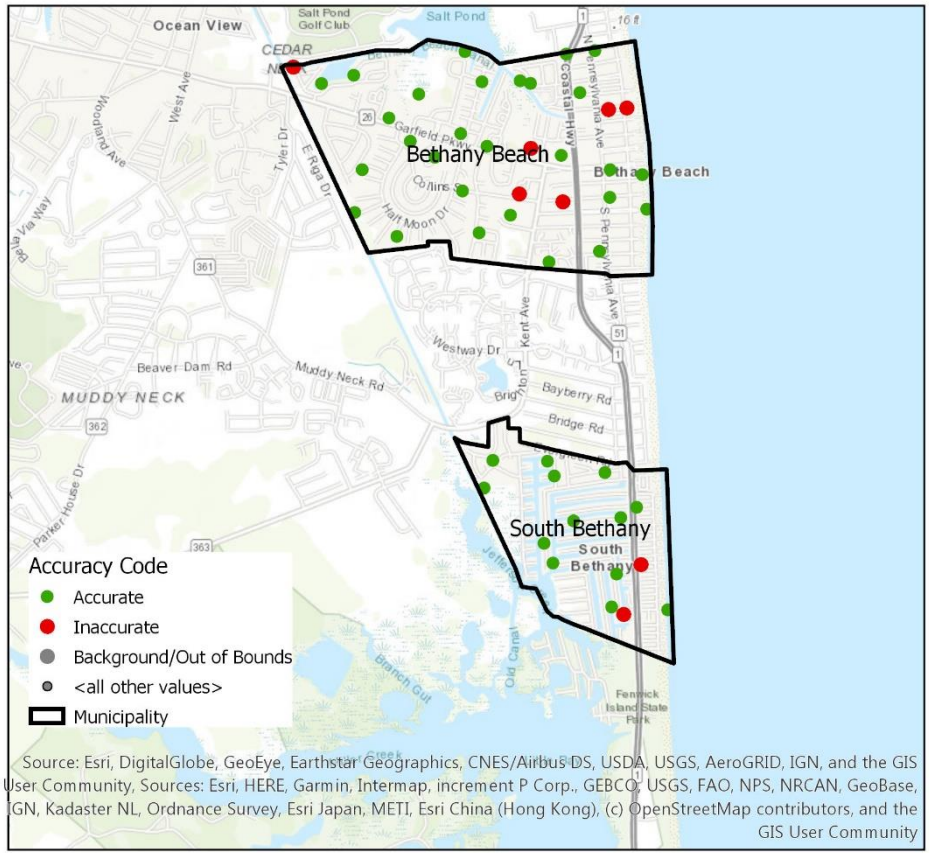
2007 Delaware layer (left)

2016 Conservancy layer (right)






Ocean View
Golf Club
CEDAR
Bethany Beach
Bethany Beach
Garfield Park
Collins St
Half Moon Dr
Tyler Dr
E Rigia Dr
Woodland Ave
West Ave
Coastal Hwy
Pennsylvania Ave
S Pennsylvania Ave
Kent Ave
Westway Dr
Beaver Dam Rd
Muddy Neck Rd
MUDDY NECK
Bayberry Rd
Bridge Rd
South Bethany
South Bethany
Accuracy Coding
Accurate
Inaccurate
Background/Out of Bounds
<all other values>
Municipality
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community


Ocean View
Salt Pond
Golf Club
CEDAR
Bethany Beach
Bethany Beach
Garfield Park
Collins St
Half Moon Dr
Tyler Dr
E Rigia Dr
Woodland Ave
West Ave
Coastal Hwy
Pennsylvania Ave
S Pennsylvania Ave
Kent Ave
Westway Dr
Beaver Dam Rd
Muddy Neck Rd
MUDDY NECK
Bayberry Rd
Bridge Rd
South Bethany
South Bethany
Accuracy Code
Accurate
Inaccurate
Background/Out of Bounds
<all other values>
Municipality
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Impervious Surface Cover

Total by municipality

Change maps

Total Impervious Cover Area

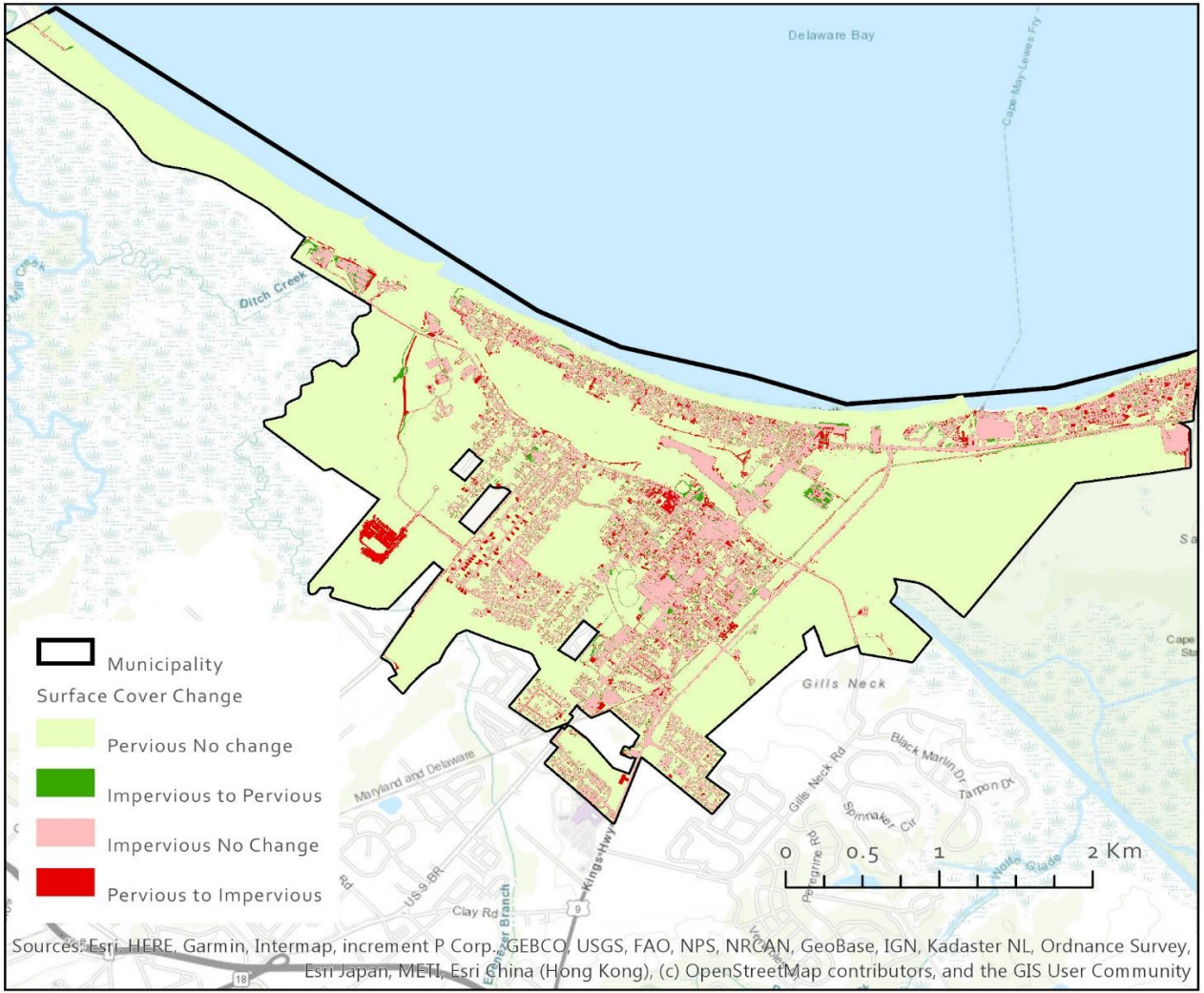
Municipality	Town Area[1]	2007 Delaware Layer		2016 Conservancy Layer		Imp Sfc Area Change[1,2]	% Imp Sfc Area Change
		Imp Sfc Area[1]	% Imp Sfc	Imp Sfc Area[1]	% Imp Sfc		
Bethany Beach	3.05	1.14	37.39	1.29	42.22	0.15	4.83
Dewey Beach	1.16	0.53	45.18	0.53	45.13	0.00	-0.05
Fenwick Island	1.30	0.41	31.45	0.48	37.10	0.07	5.66
Henlopen Acres	0.67	0.15	22.83	0.16	24.39	0.01	1.56
Lewes	11.94	2.12	17.74	2.32	19.41	0.20	1.67
Rehoboth Beach	3.90	1.35	34.44	1.35	34.70	0.01	0.25
South Bethany	1.37	0.48	35.27	0.59	42.97	0.11	7.71

[1]square kilometers

[2]2016 Chesapeake - 2007 Delaware

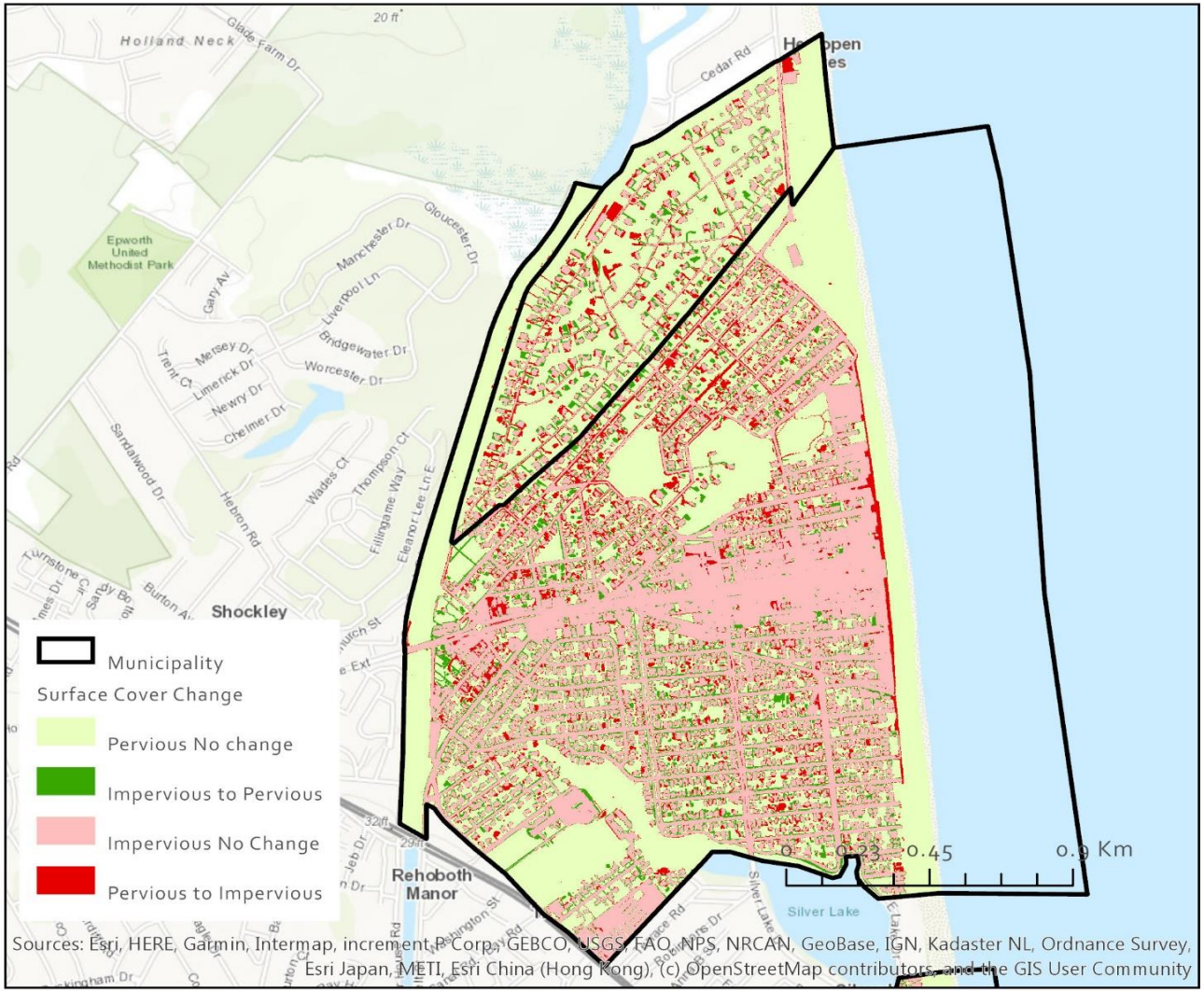
Impervious Surface Cover Change from 2007 to 2016

Lewes

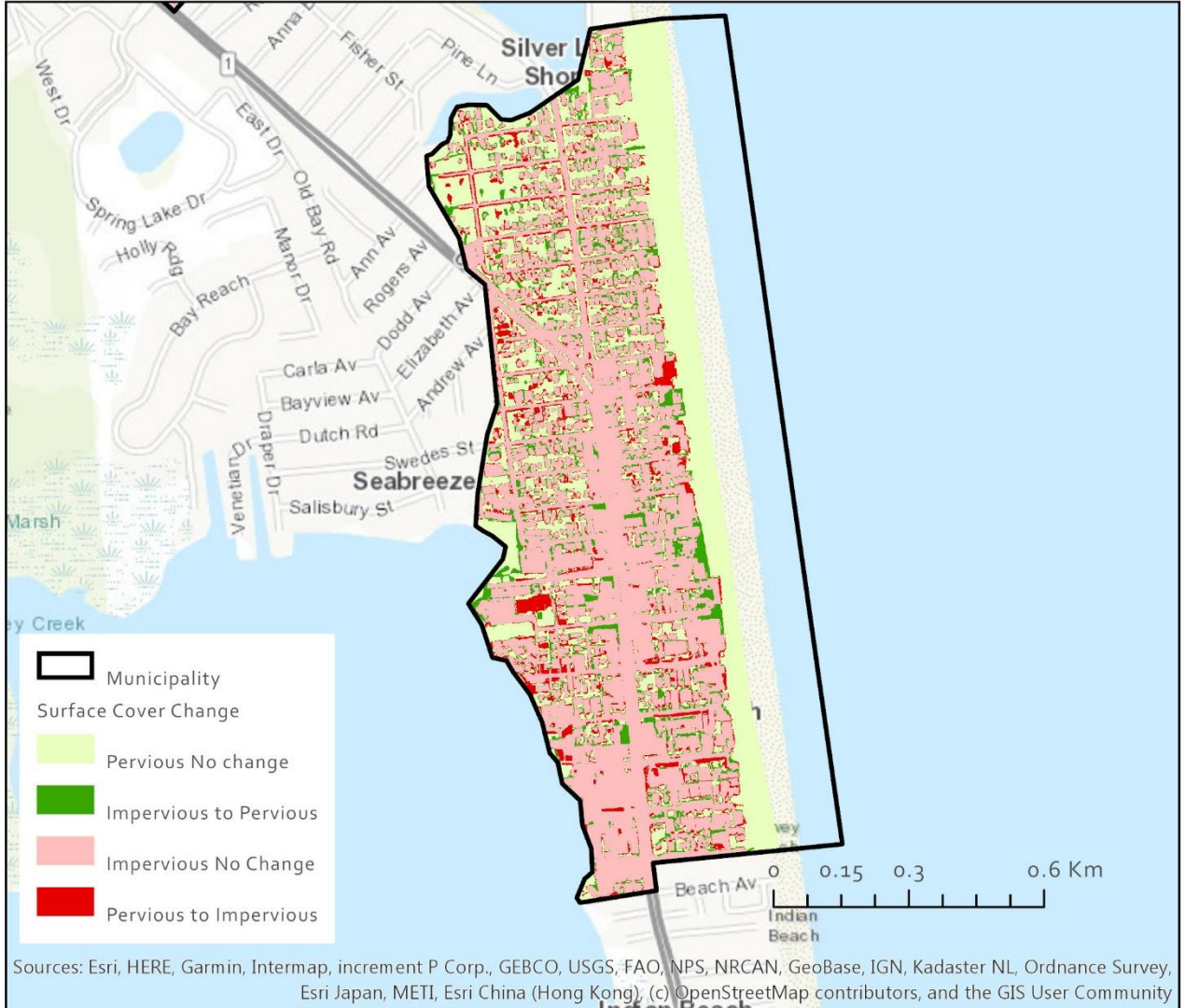


Henlopen Acres

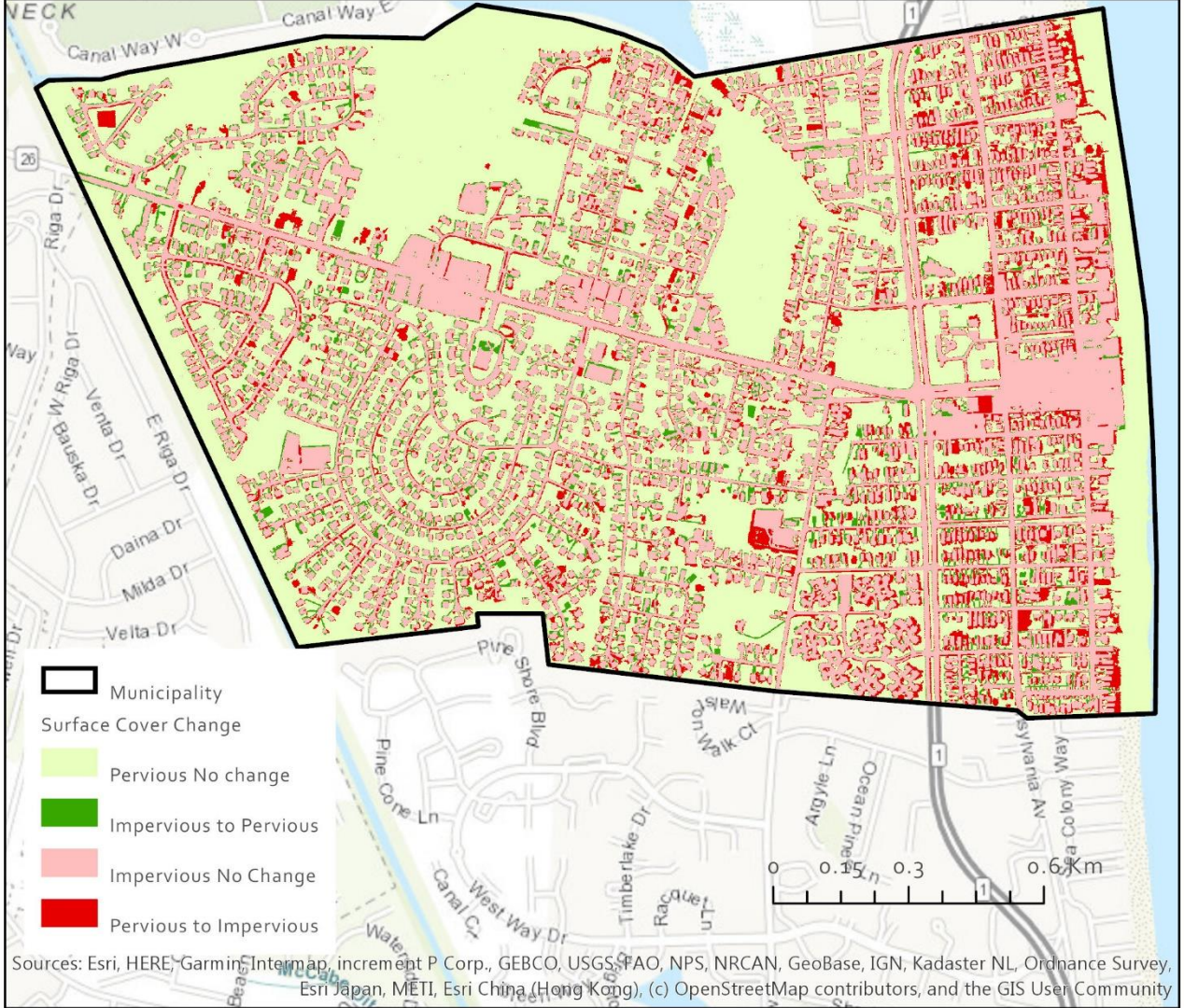
Rehoboth Beach



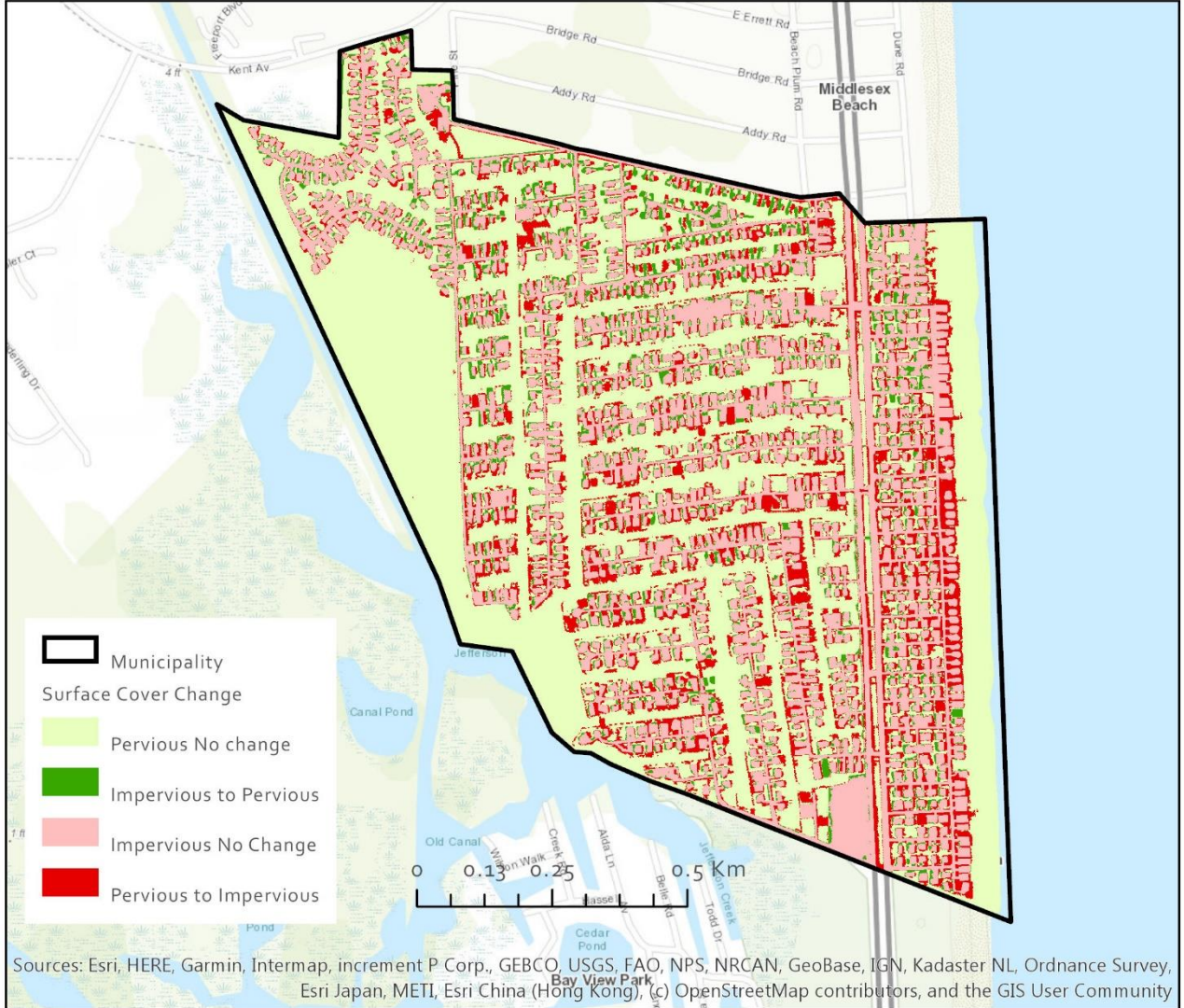
Dewey Beach


Municipality
Surface Cover Change
Pervious No change
Impervious to Pervious
Impervious No Change
Pervious to Impervious
0
0.15
0.3
0.6 Km
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

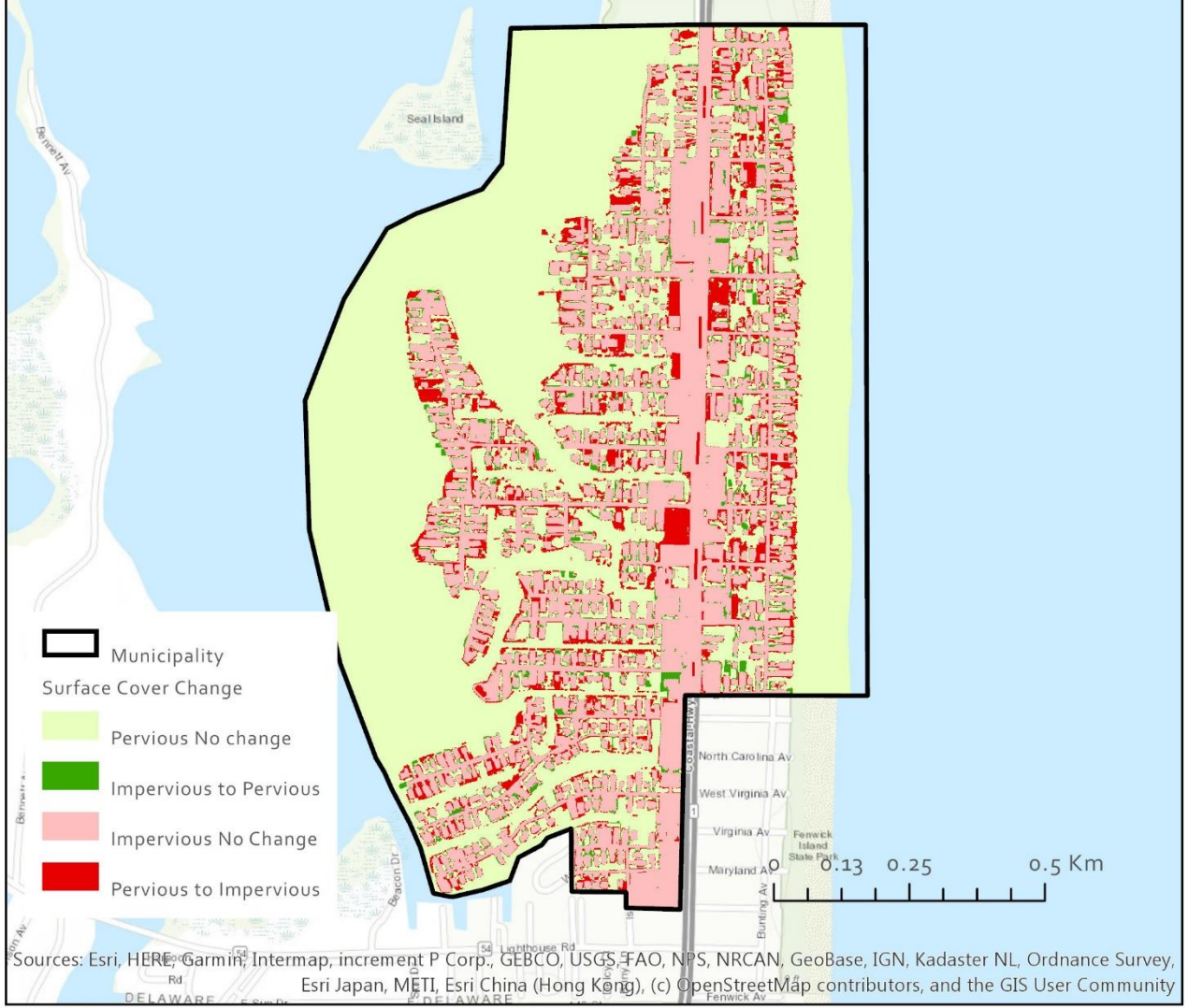
Bethany Beach



South Bethany



Fenwick Island



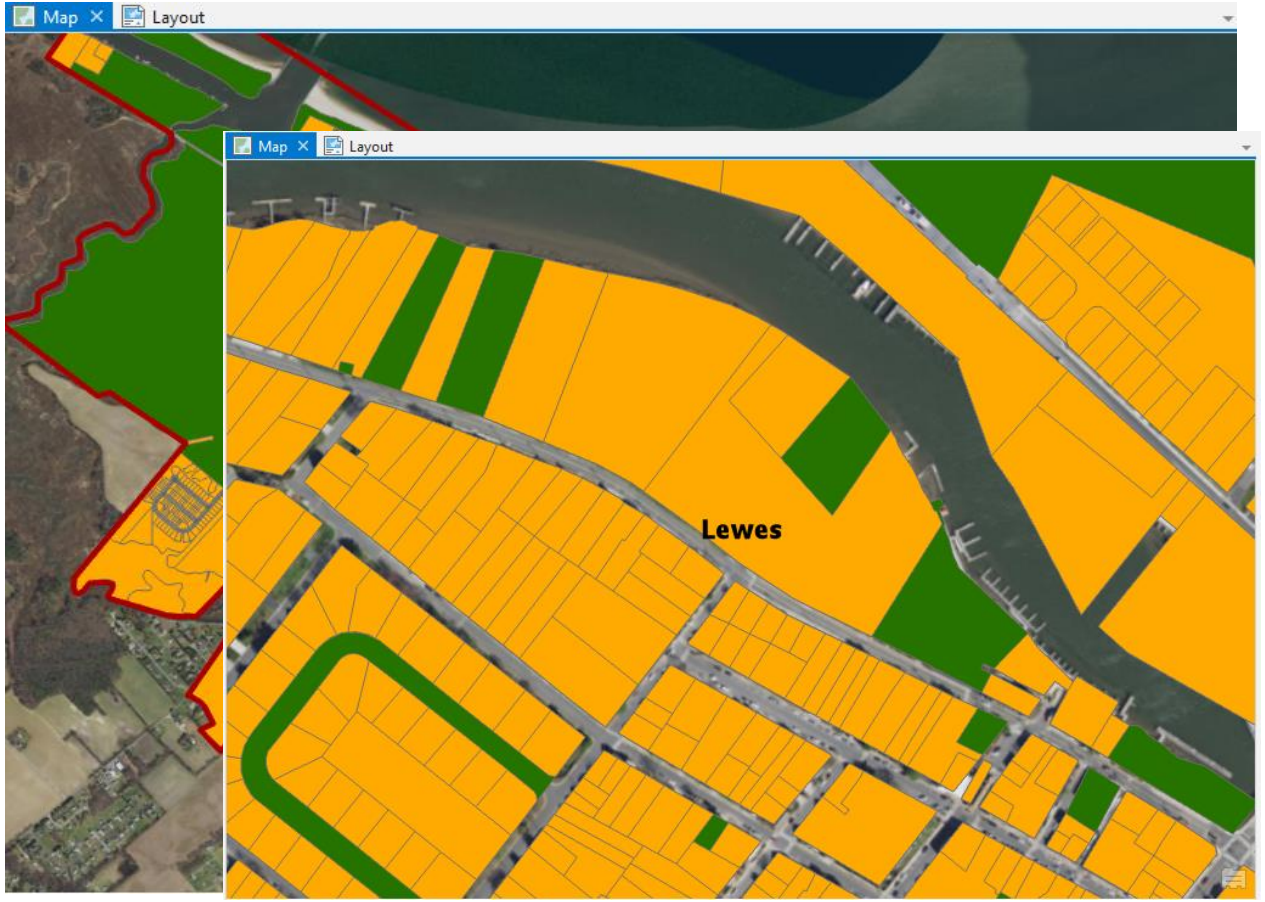
Non-Public Impervious Surface Area

Processing

Private land areas separated from public designated land (streets, parking areas, etc.) using Sussex County Parcel data obtained from Sussex County Mapping and Addressing Department

Private (orange) and **public** (green) parcels visible that are bounded by the roads and a canal.

Lewes' total parcel area of 9.6 km^2 and municipality area of 11.9 km^2.



Private Impervious Surface Area

Municipality	Private Area[1]	2007 Delaware Layer		2016 Conservancy Layer		% Private Change [3]
		Private Imp Sfc[1]	% Imp Sfc Private[2]	Private Imp Sfc[1]	% Imp Sfc Private[2]	
Bethany Beach	2.18	0.78	35.98	0.89	40.96	4.98
Dewey Beach	0.54	0.35	64.54	0.34	64.10	-0.44
Fenwick Island	0.58	0.29	50.03	0.35	60.31	10.28
Henlopen Acres	0.37	0.09	23.51	0.09	23.48	-0.03
Lewes	4.90	1.21	24.59	1.36	27.64	3.05
Rehoboth Beach	1.69	0.82	48.25	0.82	48.56	0.31
South Bethany	0.79	0.34	43.01	0.41	52.17	9.15

[1]square kilometers

[2]Private impervious surface area divided by total private land (%)

[3]2016 Chesapeake percent private impervious surface area minus 2007 Delaware percent private impervious surface area